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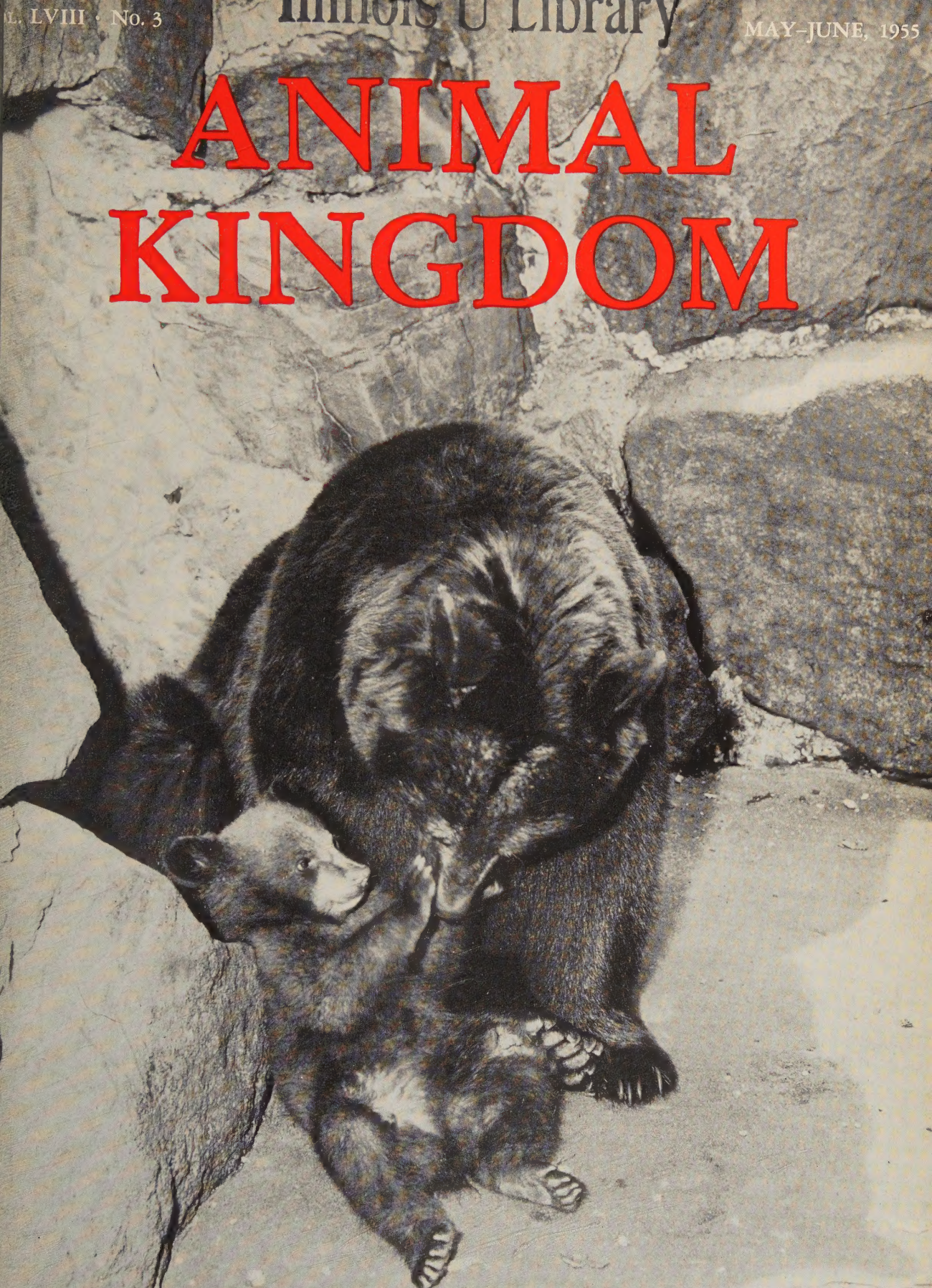
ANIMAL KINGDOM



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ANIMAL KINGDOM

Bulletin of the New York Zoological Society

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The Magnetism of Animals

THE OTHER DAY an enterprising real estate man tried a novel trick. Apparently he had been unsuccessful in getting a tenant for some ground floor space on one of the busiest intersections in the city. In order to illustrate the desirability of the space he put on an "animal show" comprised of a peacock, a sea lion, a goat and some monkeys, which he had borrowed from a troupe whose doleful destiny it was to make appearances on television. For a fortnight crowds of people, four and five deep, lined the windows just looking at the animals. Whether or not he gained a tenant is unknown but his experiment at least corroborated the fact that there is nothing like animals as magnets of popular interest. Somehow, it must be added, we felt sorry that the animals had been drawn into the world of business.

This little incident was in itself just another proof of the magnetism of animals, and one which, on an infinitely larger scale, is proving of value to our Society in these times. The animal world as a drawing power and as a focus of human interest is maintaining attendance at the Zoo at an annual figure of close to two and one-half million visitors a year. This is happening at a time when the attendance at most public cultural institutions has declined as compared with earlier annual averages. The fact is that considerable changes have taken place in the public's use of leisure time. For instance, there is the greatly increased ownership and use of automobiles. To some degree, in our case, this facilitates coming to the Zoo, as it will to the new Aquarium. However, on balance, it is proving an adverse factor not only to our Zoo but also to other public institutions because, on weekends and holidays, parking facilities are not adequate to meet the demand. Another change is the invasion of television in so great a number of American homes. The trend is towards people becoming "second degree" viewers rather than "first degree" participants. If it were not for these new trends in the use of leisure time, it is probable that our annual attendance would be hitting the three million mark because of the many improvements and attractions added to the Zoo in recent years.

All in all, we are holding our own in good shape as far as public attendance is concerned, a cheering fact for the Zoological Park and a highly promising one for the new Aquarium when it is opened next year.

Fairfield Osborn

BANANA BONANZA

By JAMES A. OLIVER

THE BANANA INDUSTRY has reaped a large harvest of material wealth from its far-flung plantations in Central and South America. The benefits of this bonanza have been spread over a large area, including all of the Americas, and have taken many forms, ranging from educational institutions to an increase in mechanization of the industry. During the development of these varied activities there have been many improvements in the methods of handling bananas to insure the delivery of tasty, ripe fruit to northern consumers. Thus the fruit is sprayed and dipped in chemical solutions before it leaves the tropics, is sealed in a protective transparent covering, travels in an air-conditioned hold of the ship, is unloaded on rubber-cushioned lifts and conveyors, and again stored at proper temperatures until delivered to the retail stores.

All of this is designed to give us properly ripened, healthy fruit.

The continuing success of this industry is attested by the recent completion in New York Harbor of the largest and best-equipped banana terminal in the world – a $1,000,000 installation that can unload 50,000 stems a day. The new terminal insures a steady supply of mellow fruit for all of us who are fond of bananas.

But what does all this have to do with the Zoological Park? Aside from the fact that a number of our animals – and employees – are fond of bananas, we have another very real interest in the banana industry. It is the source of some of our rarest and most unusual reptiles – tree-dwelling species that are difficult to collect and seldom seen in dealers' lists. These rarities are a real bonanza for *us!*

In the tropics the growing banana stalks afford admirable shelter for many small, arboreal and semi-arboreal forms of animal life. These range from tiny invertebrates, such as snails and insects, to small mammals, such as the Mouse Opossums, and include a number of species of interesting reptiles. The vast majority of species habitually found in bananas are nocturnal forms that probably use the stalks as regular daytime abodes. A few diurnal forms are found occasionally. They probably forage for food around or on the bananas and seek shelter in them when frightened. All are potential passengers on a northward voyage when the stalks of bananas are cut and shipped.

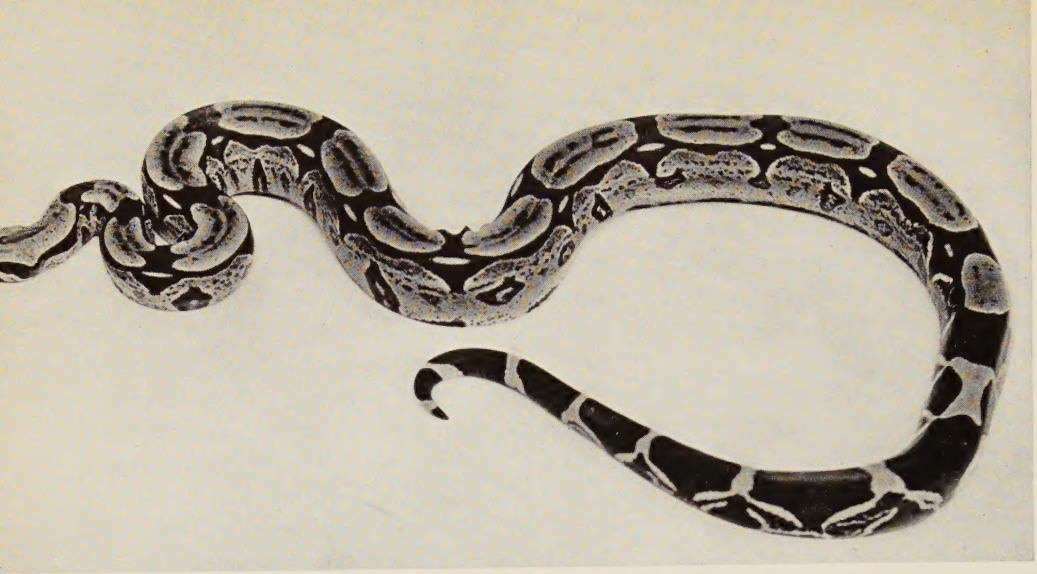
In the early days of the banana industry when the fruit was shipped unsprayed and without refrigeration, the corner grocer was the primary discoverer of the animal stowaways. In the mind of the public, Tarantulas and baby Boa Constrictors occurred more naturally on bananas than anywhere else. With the use of refrigeration and chemical sprays on the bananas the imported fauna has been greatly reduced. The few individuals that occasionally slip through despite this treatment are discovered in the unloading terminals and warehouse storerooms. A reptile on bananas in the retail grocery store is about as rare today as a model T Ford on New York's Fifth Avenue.

The Annulated Boa is rare even in the collections of natural history museums, but we received two specimens in banana shipments within a week of each other. One died, but the other is feeding well.

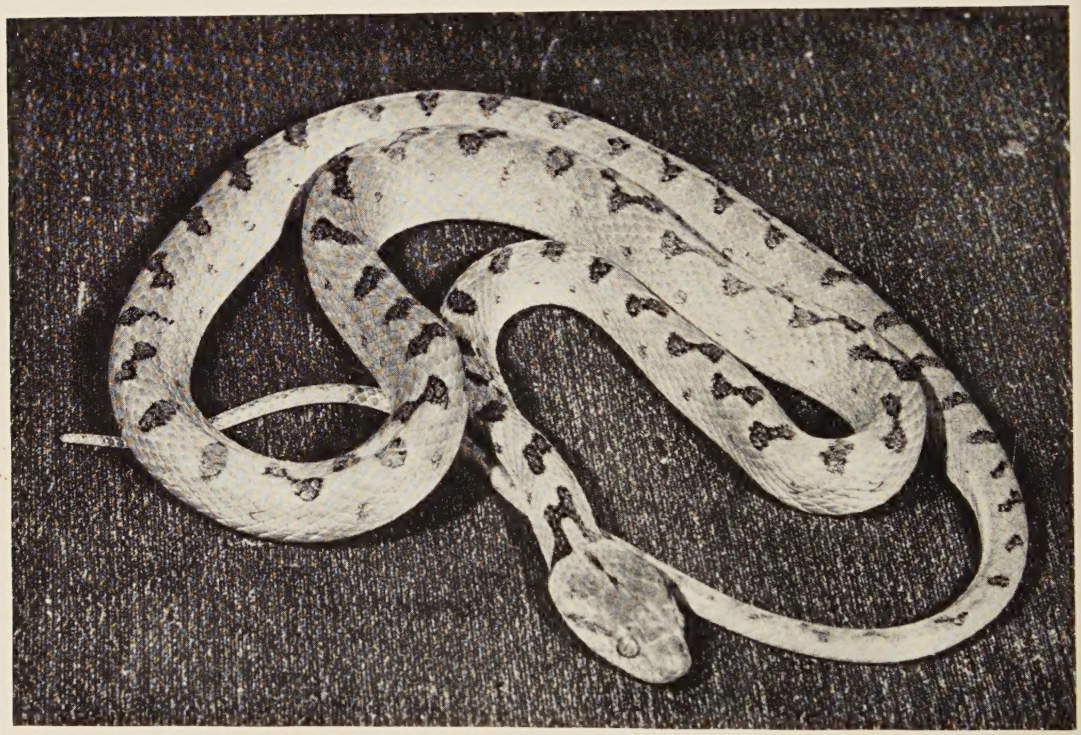
It is interesting to note that chemical treatment of the bananas is given to prevent the spread of a plant disease and not primarily to discourage animal stowaways. The trees are sprayed with a solution of copper sulphate to eliminate wind-blown spores. Then to remove the copper sulphate and its greenish color from the fruit, the stems are dipped in a weak solution of muriatic acid. These chemicals not only safeguard the plants from the disease but effectively discourage animal life from remaining in the stalks.

In spite of this attention, a few animals still manage to come through alive and, while the numbers have been decreased percentage wise, the increase in quantity of bananas imported is sufficient to supply us with occasional rare specimens. Thus we received two snakes and one lizard in 1952, four snakes and one lizard in 1953 and the same numbers in 1954. The present year is a real bonanza year for us since we have already received more specimens in the first three months of the year than we did in the preceding three-year period. Apparently the hurricanes of last summer temporarily disrupted the spraying and dipping program, much to our advantage.

As mentioned previously, the Boa Constrictor is commonly believed to be the snake most frequently found in bananas. In the four-year period covered here we have received five small Boas – three of the Central American race and two of the South American form. However, this is only the second most frequently-found reptile inhabitant of bananas and not the first. The title of the most common banana import goes to the small Spotted Night Snake (*Leptodeira annulata*). This snake, attaining a maximum length of about 24 inches, outnumbers all others in lots that we have received. It is a hardy arboreal species and is abundant throughout Central America and northern South America. It occurs in swampy woods and wet forests, as well as the banana plantations. This is a rear-fanged snake with a weak venom that paralyzes the small frogs and lizards that make up its food. I have never seen this species attempt to bite when handled,



Commonest imp in bananas aree Constrictors (top) Spotted Night Sn (below). The outnumber all o



but the bite of closely related forms is said to produce mild discomfort similar to the sting of a Honey Bee.

The third most frequently-received reptile and the only lizard that we have obtained from this source is the Spiny-Tailed Iguana (*Ctenosaura similis*). Three specimens of this lizard have come in from lower Central America. Two were small individuals, about a foot in length, but the third one, shown in the accompanying photograph, was nearly two feet long. This is a diurnal species that probably hides in the banana stems when alarmed or possibly crawls into cut stalks that are piled and awaiting shipment. It is, of course, a harmless creature.

Two diurnal snakes that have turned up once each in the past four years are the Tiger Rat Snake (*Spilotes pullatus*) and the Green Tree Snake (*Leptophis ahaetulla occidentalis*). Both of these were small individuals about two and a half feet in length. These are harmless species that feed on tree frogs, lizards, birds and small

mammals. Both are found on the ground as frequently as in bushes and trees.

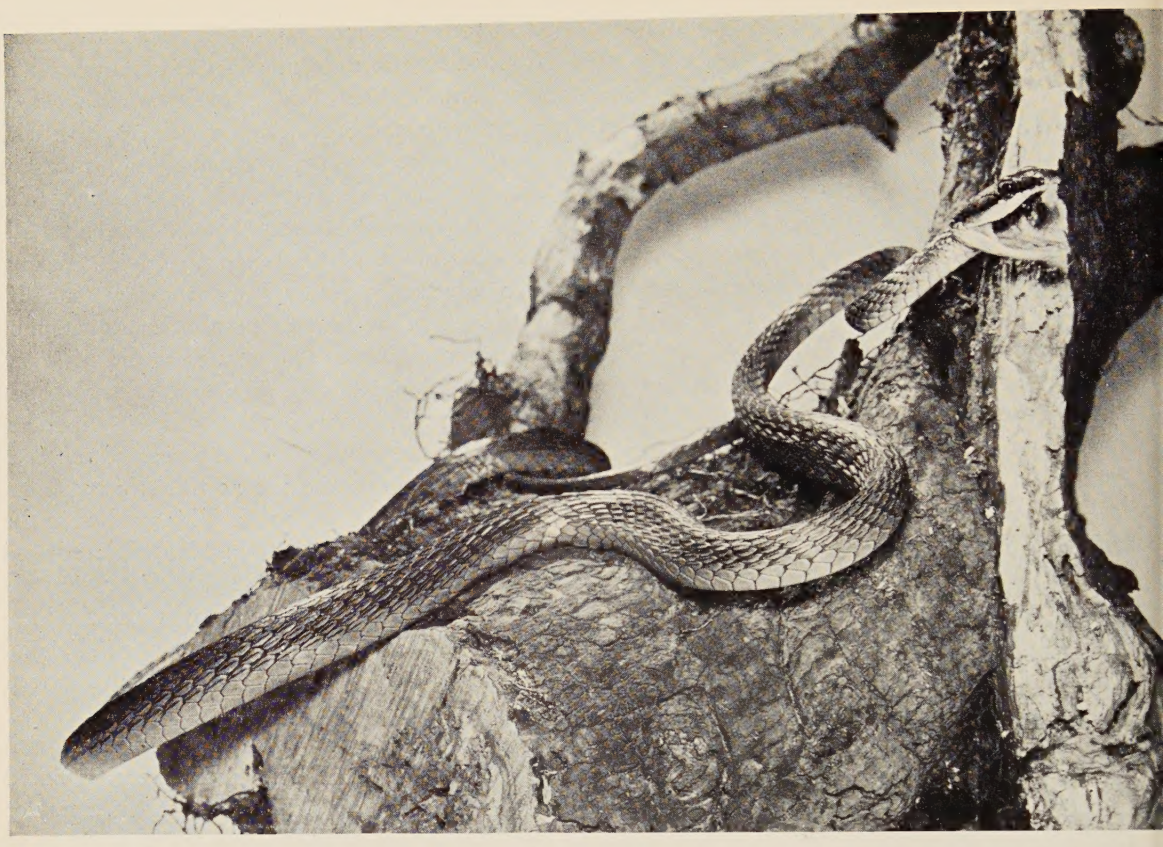
One colorful young Tropical King Snake (*Lampropeltis doliata polyzona*) that arrived in a New York banana warehouse caused considerable excitement among the employees. One of them, an amateur herpetologist of wide experience with the local fauna but little knowledge of tropical species, was certain that the snake attractively banded with yellow, black and red was a deadly Coral Snake. With understandable trepidation he herded it into a sizeable box and secured the lid with welcome relief. His misidentification of this individual was not surprising since a number of similarly-colored harmless snakes closely resemble many of the pattern variations of the tropical Coral Snkes. The color characters so useful in distinguishing the Coral Snakes of the United States from similarly-marked harmless species are of no value south of the border of the United States.

Another case of mixed identity brought an excited call from a young lad in Stamford, Connecticut. A local grocer had found a small, chunky, large-headed, somewhat greenish snake in a stalk of bananas. He had turned it over to this budding herpetologist who believed the snake was a young Bushmaster, one of the most ill-reputed snakes of the American tropics. Boxing his supposedly deadly prize, the boy took his specimen to the local museum for confirmation of the identification. The curator at the Museum was not familiar with this type of snake, but believed that it was a venomous Pit Viper because of the small pit on the side of the face between the eye and the nostril. He suggested that the snake be sent to us. This resulted in the excited call from the young lad. We advised him that we would be interested in seeing his specimen. In due time he brought it to the Reptile House and it proved to be a young individual of the Eyelash or Horned Palm Viper (*Bothrops schlegeli*).

This is an interesting arboreal Pit Viper with a prehensile tail and two or three erect pointed scales over each eye. Adults are greenish-gray or greenish-brown in life, with varying amounts of yellow and light markings, and may atttain a length of thirty inches. Our youngster is about a foot in length and is greenish with brick-red bars or irregular spots along the side. In the wild it eats small mammals, small birds and lizards. This is the only venomous snake that we have received in bananas during the four-year period under consideration and is the only one that came through a retail outlet.

The rarest of our banana acquisitions have been two small tree-dwelling boas and two delicate, arboreal snail-eating snakes. The boas are Annulated Boas (*Corallus annulatus*), a species that occurs in the wet forested area of lower Central America and northwestern South America. This form is an attractive chocolate brown with a series of deep red oval-shaped markings along each side,

The third most-frequently-received reptile in banana shipments—and the only lizard that has come to us—is the Spiny-tailed Iguana. Three have come from lower Central America and two were quite small, about a foot long. This particular specimen is nearly 2 feet long.



Only once in the past four years has this interesting Green Tree Snake turned up in shipments of bananas. A harmless species, it eats tree frogs, lizards, birds, small mammals.

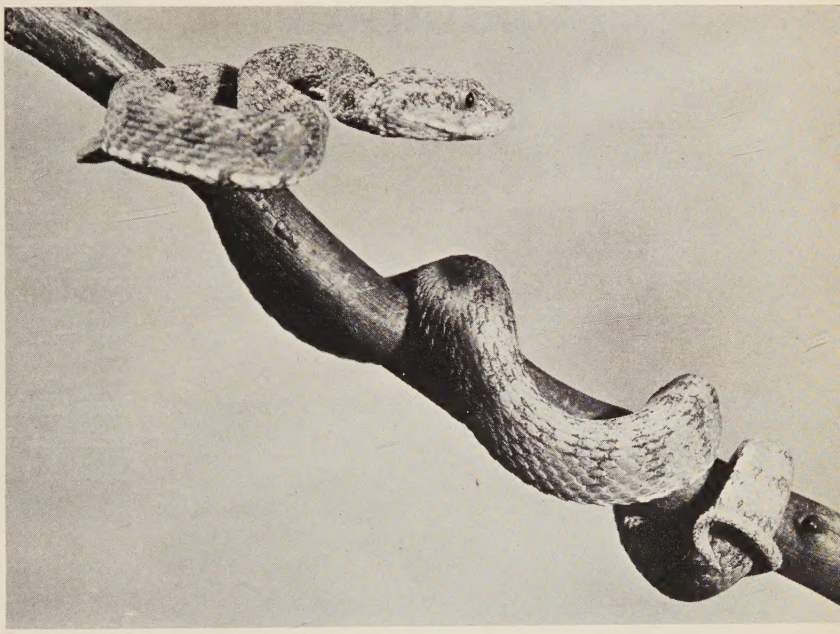
occasionally meeting on the back to form red bands. The species is so rare that only two small individuals are preserved in the vast collections of the American Museum of Natural History — both received in banana shipments. The first individual that came to us was nearly dead when received and died the next day, much to our dismay. It was the larger of the two, measuring close to three feet in length, and incidentally it became the third specimen in the Museum's collection. We were sorely disappointed at this loss because it is always a challenge to try to keep such rarities alive. Luckily, a second but smaller boa of the same species came in only a week later. This fellow appears to be adapting itself to the conditions in our Reptile House and has fed twice so far. We hope it will continue to eat heartily and have a long life with us.

The snail-eating snake is equally rare, being known from only a few preserved specimens in museum collections. Our form is known scientifically as *Dipsas variegata nicholsi* and lives in Panama and northwestern Colombia. These are slender and delicate inhabitants of wet forested areas and seldom live long in captivity. Part of the difficulty of keeping such rarities is their diet of live snails. Fortunately for us the nearby Italian markets are well stocked with several species of live European snails. Our specimens happily have accepted these as a substitute for the succulent tree snails of its native forests.

These snakes eat only the soft body of the snail, pulling it out of the shell by means of special modifications in the lower jaw. It is quite a trick to extract a snail from its shell without using any hands! Only in recent years have these modifications been described and the method of feeding reported. It requires a good deal of effort and time for our snakes to extract the European snails, which are probably larger than the species eaten in the wild. Some of our keepers tried to get the snakes to feed more readily by killing the snails and removing them from the shell. Now

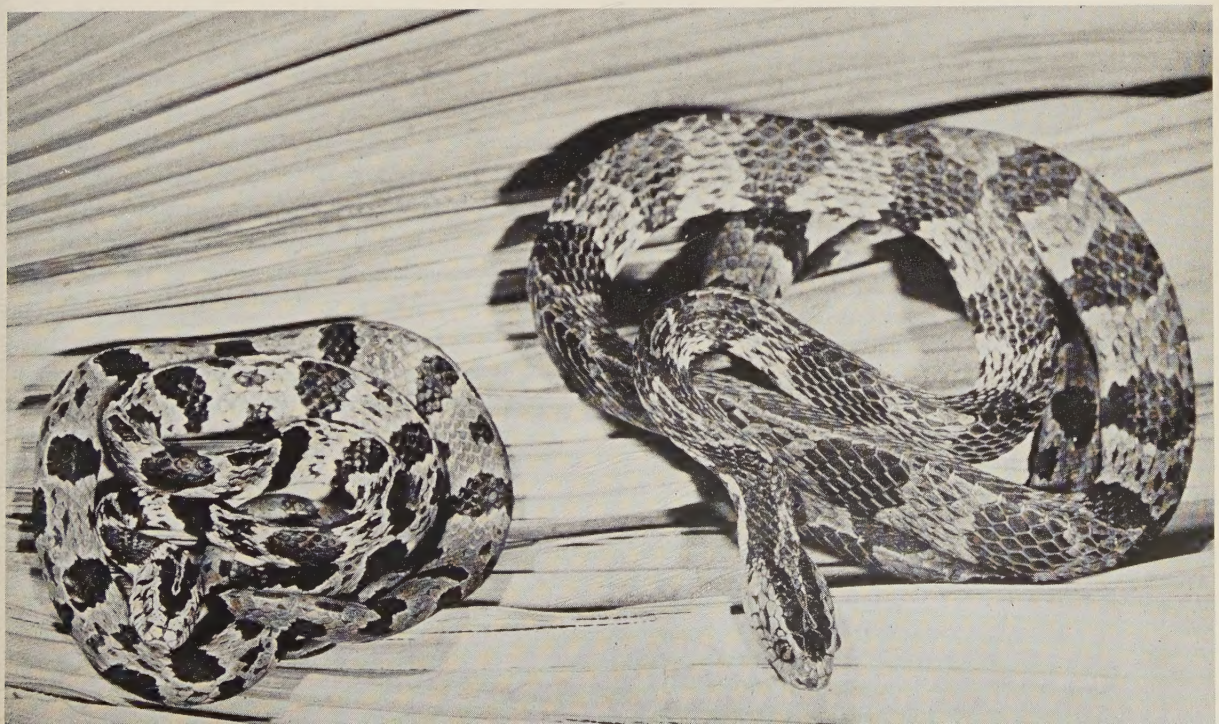
the snakes show a decided preference for snails out of the shell and have developed a marked disdain for those still in the shell, showing a highly satisfactory response to captivity. As of this writing one of our snail-eaters has been with us two years and one month — a good record for these delicate forms.

This account clearly shows that some of our most interesting exhibition specimens have come to us as our special banana bonanza. We sincerely hope that the banana industry will continue to thrive, to profit and to improve the ways of getting better and better fruit to the northern markets. *But* we also hope that improvements in methods of handling bananas will not entirely eliminate all of the animals that ride northward with the fruit. We welcome the 'phone calls that tell us of another specimen turning up, whether from an excited lad in Connecticut or from a friend at the banana terminal eager to supply us with something new. We are never sure just what will turn up next.



Venomous snakes are quite rare in banana imports, this specimen of the Eyelash Viper (also called the Horned Palm Viper) being the only one we have received in the past four years.

obably the most interesting our banana acquisitions is e Snail-eating Snake—whose etary habits are described by name. Ours is feeding well, cepting live European snails.



How Birds Handle Their Population Problem

By ALEXANDER F. SKUTCH
San Isidro del General, Costa Rica

THE RECENT great acceleration in the growth of the world's human population is causing thoughtful people much concern. Whether the fullest development of the planet's agricultural resources will finally permit it to support three billion people or six is possibly a debatable question, but there can be no doubt that the present rate of increase cannot be long continued, as nations count time, without bringing very disagreeable consequences to mankind and to the living world as a whole. On the one hand, overpopulation, with the inadequate diet, housing and educational facilities which invariably accompany it, causes the physical, intellectual and moral deterioration of men. On the other hand, the steadily mounting human population presses ever more heavily against the wilderness with all its varied life, so that the greater the number of men who inhabit the world, the less of beauty and interest it has to offer them. Thus those who love both their fellow men and the natural world have a twofold reason for wishing to see the planet's population kept within due bounds.

This population problem is not so new as we sometimes suppose. The ancient Greeks were a fecund race, and after filling their mountainous peninsula, the Aegean islands and the opposite shores of Asia Minor, sent their colonies far and wide about the shores of the Mediterranean. The two leading Greek philosophers, Plato and Aristotle, gave serious attention to the regulation of the number of men in their ideal states. And long before their time, the wanderings of Neolithic peoples, revealed to archaeologists by the changing distribution of their artifacts, suggest that savage and barbarian tribes frequently outgrew their means of subsistence.

It is far easier to recognize the dangers of overpopulation than to prevent it. Perhaps some light might be thrown upon this difficult problem by considering how it has been met by other species of animals, which like men are capable of producing far more progeny than the land can support. If their solutions have not been reached by intelligent planning, but rather through their millennial interaction with their environment,

they are not for this reason less likely to be illuminating to us. And since the goal of all attempts to regulate human population is to maintain it at a steady level, avoiding the plagues, famines and wars that may suddenly and drastically reduce it, we shall turn for enlightenment to those animals which seem to hold their numbers fairly constant over long periods, rather than to lemmings and other northern vertebrates which pass through cycles in which years of tremendous abundance alternate with years of scarcity.

Those who have studied birds in the wetter areas of the tropics, where heavy forests are the natural vegetation, have been impressed by the constancy of the population of the more common birds, which seem to be present in about the same numbers year after year. One reason for this is the absence of great and widespread catastrophes, such as the blizzards which in northern lands take so heavy a toll of those hardy birds which brave the winters, and the adverse winds which often destroy countless thousands of the migratory kinds. Unlike the birds of high latitudes, most of those of the humid tropics reside the year around in the districts where they breed. Here destructive cataclysms, like volcanic eruptions and hurricanes, are rare and local, not affecting great areas like a devastating winter. Unfortunately, it is difficult to make an accurate census of the birds anywhere, and especially in the heavy vegetation of the tropics; so that our belief that the avian population is fairly constant from year to year is based upon general impressions, or the number of nests in a small area, rather than upon careful counts of whole populations.

The absence in the humid tropics of recurrent spells of severe weather which decimate the bird population is balanced by a low rate of reproduction which cannot increase it rapidly. Ornithologists who visit the tropics from the north are impressed by the small sets of eggs they find. A few avian families, such as pigeons and hummingbirds, lay the same limited number of eggs in whatever zone they breed; but in most groups of birds the tropical members lay smaller sets than the extra-tropical members. Here in southern Costa Rica, most of the nests I find contain only two eggs; sets of three are not uncommon; but those of four are rare, and still larger sets exceedingly rare. In the northern United States, on the contrary, sets of two are rare except in pigeons, hummingbirds and goatsuckers, whereas sets of three to five are perhaps the most frequent among small land birds and far larger sets are found in ducks, pheasants and other families in which the young pick up their own food soon after hatching.

This increase in the size of sets with latitude holds good within families, genera and even wide-ranging species. In Costa Rica the Marbled Wood Quail lays four or rarely five eggs, but in the United States the Bob-white Quail lays from 12 to 18 in a nest. In this locality the Southern House Wren lays three, four or very rarely five eggs, but the North American House Wren has sets of six to eight. With us, Gray's

e Russet-capped Nightingale-thrush (left) and r nest (right). Thrushes of tropical America about half as many eggs as northern thrushes.

All photographs by the author.

Thrush lays two or three eggs, while the American Robin incubates three to five at a time. Innumerable instances of the same sort might be given. There is, however, no abrupt decline in the size of the set as one passes the Tropic of Cancer or of Capricorn; the "latitude effect" holds good within the tropics and beyond them; so that there is in general a slow but steady increase in the size of sets as one passes from the equatorial to the Arctic regions. The wide-ranging Tropical Kingbird (represented in the United States by the race known as Couch's Kingbird) lays sets of four in the South Temperate Zone in Argentina, sets of two or less often three in southern Central America, sets of two to four in

The Ruddy Rail lays 3 or 4 eggs in Honduras, while the northern rails lay much larger sets of 6 to 12 and sometimes even more.

A typical brood of Amazon fishers—four youngsters. Kingfishers in the north have families of five to

northern Central America, and from three to five in northern Mexico and southern Texas. In the Old World, this increase in set size with latitude has been demonstrated for a number of species in tropical Africa by Mr. R. E. Moreau and in Europe by Dr. David Lack.

One at once asks whether the smaller size of individual broods at lower latitudes might not be compensated by a greater number of nesting attempts in the course of a year which, at least so far as temperature is concerned, seems constantly favorable for breeding. Here in Central America a few hummingbirds, antbirds, pigeons and others are known to nest, *as species*, through most or all of the year; but there is no evidence that any individual has so long a breeding season. Many of the birds in this region raise two or at most three broods, laying two eggs each time, so that they could not possibly equal the output of a finch of the far north, such as the Snow Bunting, which may follow a successful first brood of six young by a second brood of three. But the most prolific of the birds that nest about my house, the Southern House Wren, with its three or four broods of three or four young each, about equals the annual productivity of its northern relative, with two broods of five to seven.

And now for the question most interesting to us from the point of view of the control of population: why do the tropical birds so often lay smaller sets than the most nearly related forms at higher latitudes? Is it, as Dr. Lack has contended, because they cannot adequately nourish larger families? Since birds generally breed when the sun is on their side of the Equator and days are longer than nights, diurnal species nesting at higher latitudes have a longer period of daylight for gathering food for their families than those of regions near the Equator where day and night are approximately equal at all seasons, and this increase in day-length is progressive until in Arctic regions in June the nesting birds enjoy continuous daylight, although they find it necessary to take a few hours of rest in each twenty-four-hour period.

There is one obvious reason for believing that birds everywhere – and other animals, too – must raise as many offspring as the parents can adequately feed without impairing their own health and strength. In many species we find occasional broods larger than normal, and it seems likely that the capacity to lay these larger sets of eggs is heritable. That race or strain within the species that produced the greatest number of

healthy offspring would multiply more rapidly, and so in the course of generations become the prevailing type. This would seem true even if the more rapid reproduction led to great overpopulation and hence to an extremely heavy annual mortality, which would occur chiefly during the season when food is scarcest and conditions on the whole least favorable. For we have supposed that individuals from larger broods are in no way inferior in strength and vigor to those from smaller broods, so that the two groups should lose the same proportion of their total number.

Dr. Lack's careful studies of Swifts, Starlings and other European birds indicate that broods are normally as large as can be adequately nourished; and when more than the usual number of eggs is laid, if some of the resulting young do not succumb in the nest they are likely to leave it underweight and so begin their active life at a disadvantage. Thus the largest broods do not necessarily produce the greatest number of mature offspring, and over the centuries the fecundity of the females has been so adjusted that in a given region they lay sets of a size which in average conditions will yield the maximum number of healthy progeny. But the birds of central and northern Europe, where these studies were made, must either perform a long migratory journey or else face a winter which is often severe. In either case, they confront great hazards which birds of the humid tropics do not know, and from time to time are decimated by adverse weather. After each of these periodic catastrophes they begin the breeding season with greatly reduced numbers, and so resemble a pioneer or freely expanding population, in which large families enjoy an advantage they do not have in more densely populated communities. These occasional depressions in population density give the more prolific strains within each species an opportunity for increasing their number which they would lack if the population remained steadily near its optimum.

We must be careful how we extend to the tropics the results of studies made in the very different conditions of northern lands. There are several reasons for believing that in the humid tropics birds do not on the whole rear families as large as they can adequately nourish. The nests that I most frequently find in the underwood of the rain-forest on my farm belong to hummingbirds, manakins, antbirds, finches and tanagers. In hummingbirds and manakins, the male does not share the labors of the nest and to the female alone falls the task of raising the nestlings. In the antbirds, tanagers and finches, the male takes his due part in feeding the young, and the male antbird even helps to incubate the eggs and brood the nestlings. Yet in both of these

The Violet-eared Hummingbird feeds her nestlings in a cypress tree in Guatemala. The few hummingbirds that nest at high latitudes preserve the family tradition of broods of two.

classes, the number of eggs is regularly two. If the solitary manakins and hummingbirds can rear two nestlings, it would seem that with an equal effort the antbirds, tanagers and finches, with both parents cooperating, could raise four instead of the two which I nearly always find in their nests. It might be argued that differences in food account for the smaller number of young for each attendant in the antbirds, tanagers and finches, but I doubt that this is the true explanation. Among the smaller American or "Tyrant" Flycatchers, there are species in which both sexes feed the young and species in which the female alone attends them, yet there is no constant difference in size of broods in the two groups. Taking the tropical American birds as a whole, there are many altricial or nidicolous species of the most diverse feeding habits in which the female alone attends the nest, and most of these lay two or three eggs, like the majority of the females whose mates regularly help to feed the young. This is to me a most convincing reason for believing that when the two parents join in feeding the young, they are not working as hard, or rearing as many offspring, as they might easily do.

Other observations, less convincing in themselves, support the conclusion drawn from the lack of correlation between the size of the brood and the number of attendants. Rarely a species which normally lays two eggs will produce a set of three; and in four of the five such cases which I studied, the larger family was successfully fledged. Many of the small birds of the tropical forest bring their nestlings big portions of food at rather long intervals; and the advantage of this seems to be that the fewer the visits to the nest, the less likely are the parents to betray its position to predators which rely chiefly upon sight, such as snakes and hawks. Yet if these parents with slow rates of feeding are kept away from their nests until their young are unusually hungry, they can greatly accelerate their rate of food-bringing, as I have seen on several occasions with antbirds. This suggests that food is not hard to find in the rain-forest, and in nourishing their usual brood of two the birds are by no means working to the limit of their strength.

We can hardly escape the conclusion that small birds of the humid tropics do not raise broods as large as they could adequately attend; nor do they seem to attempt as many broods in the course of the year as their own strength and external conditions would permit. Their rate of reproduction seems to be adjusted to their annual losses rather than pushed to the limit of their capacity, as appears to be true of a number of northern birds. Another wholly distinct set of facts reveals that birds as a class do not reproduce as rapidly as they might. Anyone who has

kept domestic quadrupeds, such as horses and cows, knows that they can breed before they have stopped growing, and the same is true of man. But wild birds seem practically always to reach full adult size before they begin to reproduce. Many of the larger birds, as penguins, herons and petrels, delay to breed until several years after they have attained adult stature. The Royal Albatross does not start nesting until nine or ten years of age, and the Fulmar of the North Atlantic not before it is seven years old, or even eight or nine. Like other petrels, the Fulmars incubate one egg at a time, yet in recent decades they have been spreading in a spectacular fashion about the shores of the British Isles, indicating that their slow rate of reproduction is quite adequate for maintaining their numbers and even for rapid expansion.

Is it not remarkable that these birds and numerous others should require a longer period to reach reproductive maturity than many mammals whose size is so much greater than theirs? It appears that after they have completed their growth in stature some inhibiting factor comes into play and delays for one or more years the development of their organs of reproduction; and in view of the fact that these birds are quite capable of maintaining their numbers, it seems that this is an adaptation to prevent superfluous breeding and overcrowding, with resulting strife between individuals and starvation. It is far more difficult to understand how such an adaptation could evolve than in the case of many modifications which give a more immediate and obvious advantage to the birds which possess them, such as stronger flight or better concealment of the nest. But the subtle interactions between living things, continued for countless generations, produce results which are far from obvious and confound our too facile theories.

To conclude, birds avoid excessive increase in numbers in two distinct ways. Many of the longer-lived species delay breeding for one or more years after they have attained adult stature. Many tropical species lay only two or three eggs in a set although they seem capable of giving adequate care to larger families; and they do not compensate for these small broods by raising a larger number of them each year. These adjustments are not, like late marriage and small families among ourselves, socially determined practices, but are controlled by genetic modifications that have arisen in the course of a long evolution. We know little of the manner in which these adjustments were brought about; but in view of their relevance to one of the most pressing problems of mankind, they seem worthy of our careful study.

The Fish with Holes in Its Head

By JAMES W. ATZ

If, in a game of charades, you were called upon to act out the word "fish," the chances are that you could make yourself most recognizably fish-like by looking wide-eyed while you puckered your lips and with them made motions as if blowing bubbles. Even persons whose acquaintance with living fish consists solely of a glance or two into a goldfish bowl would identify the unblinking eye and constantly opening and closing mouth as characteristic of the fish. In fact, so many people have noted how fish continuously take in water through their mouths that when we want to describe a heavy imbiber of our own species we say that he drinks like a fish.

Of course, most of us know the fish is not drinking all that water. Rather it is breathing it. Just as we must regularly take air into our lungs, so must the fish keep a continuous supply of

water passing over its gills. But the differences between the breathing of man and fish embrace more than the dissimilarity between lungs and gills or air and water. In man the air enters the lungs by way of either nose or mouth and it leaves by the same two confluent ways, while in fish the water can enter only through the mouth, and it leaves the gills by an entirely different route, passing out under the gill-covers on either side of the rear of the head.

There are, however, so many different kinds of fishes – some 25,000 or more species – and so varied are they in structure and way of life, that the ichthyologist is not surprised when he finds exceptions to almost every generalization that has ever been made about them. For example, there are a number of fishes that breathe air, like terrestrial animals, instead of water. Many of these drown if kept under water and not allowed to come to the surface to gulp air. Then there is a handful of fishes in which the nose communicates with the mouth. (The typical fish nose consists of a U-shaped tube, both ends of which communicate with the outside of the body). In these the nose may be used for breathing as well as smelling, the latter being its sole function in the vast majority of fishes.

The Aquarium recently acquired another outstanding example of a fish with peculiar methods of breathing. Although it possesses gills like any ordinary fish and breathes water, too, it can do this without taking any water at all into its mouth.

So far as we know, this fish has never been kept in captivity before outside of its native Thailand, and has never been assigned a popular name – except for some local Siamese ones given to it. Its scientific name is *Gyrinocheilus aymonieri*. In order to provide the fish with a more descriptive, if no more euphonious appelation, we propose to call it the Siamese Head-breather. As pointed out before, most fishes are mouth-breathers; the fact that *Gyrinocheilus* is not is its greatest claim to ichthyological fame.

Looking at the Siamese Head-breather for the first time, one is not impressed by any outstanding peculiarity in form or behavior. Certainly it would not appear to warrant the distinction of being in any respect "the most remarkable of Oriental fresh-water fishes," as Dr. Hugh M. Smith, the great authority on Siamese fishes, once called it.[1] The fish looks and acts as if it were one of the many suckers that frequent the bottoms of streams and lakes of North America. Only an expert would be aware of the differences in conformation as well as fin and mouth structure that show that despite its rather sucker-like mouth and shape, it is not a sucker at all.

Its outstanding structural peculiarity might pass unnoticed, even though it is apparent once it has been pointed out. Behind each eye, just above the gill-cover, is a good-sized opening which seems to lead straight into the head. In our three-and-one-half inch specimen, each of these openings was slightly more than an eighth of an inch in its greatest dimension.

[1] Smith, *Bull. U. S. Nat'l Mus.*, (188): 281-286, 1945.

Just inside is a membranous flap of skin that undoubtedly acts as a valve, for it may be seen rapidly moving back and forth when the fish is breathing. At the same time, a thin flap running along the edge of the gill-cover, which lies directly below the opening, also vibrates so that it rapidly opens and closes the narrow slit separating the gill-cover from the body. Water for respiration enters the two openings and passes forward to the anterior limit of the gill chamber. Then it flows down and back over the gills, being drawn out through the opercular slit by means of the vibrating flap along the gill-cover's edge. Not much water can be drawn in through the two openings, but the extreme rapidity with which the opercular flaps move seems to compensate for this. As many as 240 back-and-forth movements per minute have been counted.[1] Apparently the Head-breather cannot breathe in an ordinary manner, that is, through its mouth, even though that organ is still connected with the gill chamber on either side of the head.

he hole in the fish's head is st in front of the dark pigment pot behind the eye. Here it ppears closed by the valve.

This Siamese Head-breather is 3½ inches long, but it is recorded in the wild state up to a length of about 8 inches.

The utility of this arrangement is obvious, once the Head-breather's habitat and feeding methods are considered. The fish lives primarily in mountainous streams, and even when in an aquarium of standing water can be seen clinging to the bottom or sides by means of its sucking mouth, all the while breathing water through the two extra holes in its head. The ability to fasten itself to a rock for extended periods must keep the Head-breather from being washed downstream by the torrential flow of water in its native streams. Moreover, it feeds exclusively, or almost so, on algae scraped from the surface of underwater stones. Here, too, the fish can occupy its sucking, scraping mouth entirely with food-getting while respiration takes care of itself. Like many other vegetarian fishes, the Head-breather's intestine is long and coiled to allow ample space and time for the slow digestion of tough plant materials.

All this makes the Siamese Head-breather and its close relative, the Bornean Head-breather, *Gyrinocheilus pustulosus*, unique. No other fish exhibits such inhalent openings to the gills. Because of them and certain other more-or-less associated structures, ichthyologists have put these two species into a Family of their own.[2]

Our specimen of Head-breather came from one of the tanks of Mr. Sol Soberman, a Bronx fish fancier. Mr. Soberman had recognized his fish as a queer one, but it was Mr. Joseph Armstrong, our new Tankman, who identified it as a real rarity and urged Mr. Soberman to present it to the Aquarium.

One of the most remarkable things about the Siamese Head-breather is its ability to thrive in small standing aquaria. This faculty, which is highly unusual for a fish used to swift flowing waters, finds at least a partial explanation in the fact that the fish is not confined to mountain streams in nature but also occurs in still waters. Nevertheless, the aquarist must consider himself fortunate that this is indeed the case. More Head-breathers will undoubtedly turn up, and when they do, they should easily be maintained both in the laboratory for study and in exhibition tanks for the public to see.

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[2] Ramaswami, *Proc. Nat'l Inst. Sci. India*, 18 **(2)**: 125-140, 1952.

Black Bear Cubs at Last

Photographs by

SAM DUNTON

The Black Bear cubs whose first excursions out of doors under their own power we have been awaiting eagerly since the end of January, finally made their appearance on April 15—two and a half months after their birth on January 31. Although the volume of sounds from inside their den in a rock ledge indicated that there might be three, the number turned out to be two. Cubs are often destroyed by the father; in this instance the male died before the cubs were born.

A section of hollow log is the only plaything the cubs seem to be interested in—but it holds an unlimited possibility for fun.

As little teeth grow longer and sharper, we are probably going to need a new log. Already it is well-scarred by their teeth.

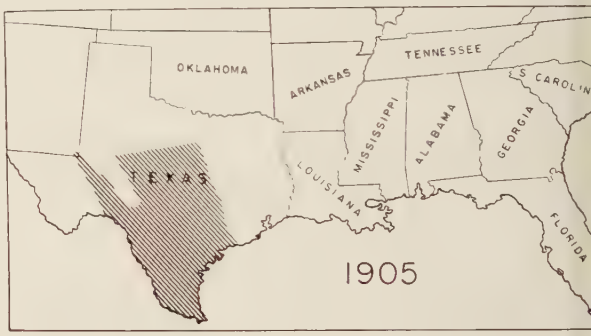
NINE-BANDED ARMADILLO—

Invader from the South

By G. DALE BUCHANAN

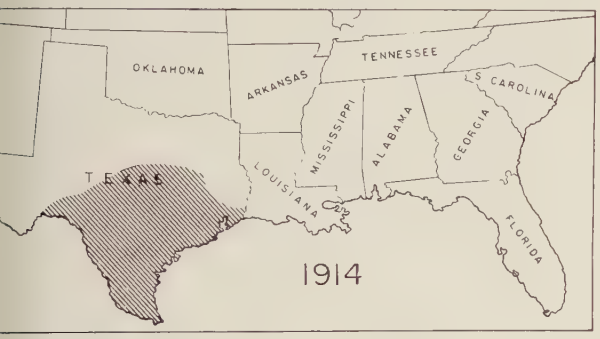
Graduate Assistant in Biology, The Rice Institute, Houston, Texas

In 1854 J. J. Audubon published Volume III of his monumental and beautiful *Quadrupeds of North America* and in it is the first reference to the Nine-banded Armadillo in the United States. Audubon reported that the animal occurred in the southern portion of Texas along the lower shores of the Rio Grande river. Exactly one century later the *Texas Journal of Science* published an article, written in part by myself, in which the armadillo is reported from every state along the Gulf coast, as well as Oklahoma and Arkansas, and still spreading. This is no startling revelation, since it has been known for a long time, and suspected even longer, that *Dasypus novemcinctus*, like the conquistadores of old, was sweeping northward from the plains of New Grenada. Yet each chronicling of the whereabouts of this not-so-furry friend of ours brings to the mind of the naturalist a host of questions. When did the armadillo begin the expansion of its range? What started it? How far will it go? When and where will it finally halt, and what may halt it?



These four maps stair-stepping across the page show how widely the Nine-banded Armadillo has extended its habitat since 1880. The Florida colonies were introduced by man; other extensions of the range are natural.

To find the answers to these questions – if, indeed, they are answerable – we must know something of the nature of the beast. One's first glimpse of an armadillo, whether it be the first ever or merely the first of the hour, is always disconcerting, for it seems as if it might, equally well, be either a reptilian mammal or a mamalian reptile. Even when reciting its taxonomic



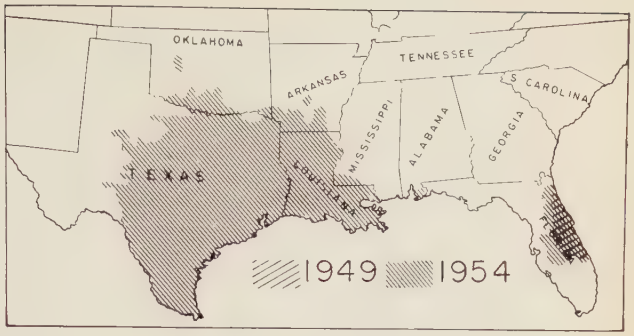
pedigree there is an urge to look behind to see if perchance, like Alice, one has stepped through the looking glass.

As a matter of fact, the armadillo looks not at all unlike the Mock Turtle and is almost as unlikely.

Except for the ears, which are decidedly mulish, the armadillo's head resembles a pig's. The shell obscures all contours of the body and the animal is perpetually peeking at the world as from beneath a bowl. When the shell is removed, the carcass is about the size and shape of a rabbit's, except that it is much sturdier.

Most people tend to look upon the armadillo as a rather primitive animal, because of its generally reptilian appearance and its obvious affinity with the extinct glyptodons. Primitive in the sense that it comes from an ancient stock it may be, but primitive in the sense that it lacks complexity it most certainly is not. The reproductive cycle of the armadillo presents two of the most baffling and interesting aspects of mammalian reproduction. The Nine-banded Armadillo and a related species, the Mulita Armadillo (*Dasypus hybridus*), exhibit specific polyembrony, giving birth to quadruplets and octuplets respectively from a single egg.

In addition, the armadillo has incorporated into its reproductive cycle a phenomenon which, while of little apparent value to it in its South



American habitat, may be of great importance in allowing it to move into more temperate climates. Armadillos mate in the late spring and early summer but because of a period of delayed implantation, of some four months' duration, gestation does not start until early winter. As a result the young are not born until the spring of the year, which probably increases considerably their survival chances.

One's first impression of an armadillo is that it is remarkably stupid. Later observations only tend to confirm this idea. The armadillo has a highly developed sense of smell, being able to locate insects and worms beneath six or more inches of earth. It is asserted that the armadillo employs its nose as its first line of defense also. This idea is supported by the animal's habit of rearing up on its haunches and testing the air. On the other hand, an armadillo is likely to walk right up to a man and sniff about as if it had absolutely no sense of smell whatsoever. Its hearing has been described as poor by many observers, but the evidence is conflicting. On occasion an armadillo may be quite sensitive to noise, moving away at the slightest crackling of a leaf. At other times it may be approached noisily without it acknowledging one's presence. Its eyes are poor at best and it makes little use of them. If one can be induced to flee, it is as likely to charge headlong into a tree as go around. We can only conclude that except for the eyes its senses are not inadequate but that its response to sensations are inconsistent, to say the least.

Although it is generally silent, the armadillo is not mute. The sound most often heard is a sort of wheezy grunt, usually made when digging or feeding. There is also a buzzing noise, made when the animal is thoroughly alarmed. The buzzing sounds much like a wind-up mechanical

toy when it is allowed to run wild at top speed.

The armadillo is considered to be nocturnal or crepuscular. While this is ordinarily accurate, there is reason to believe that it is oriented not so much with respect to light as with temperature. It is true that during the summer the armadillo seldom goes abroad until dark, but if the temperature happens to fall during daylight hours as a result of a shower, it may be seen shortly thereafter. In cold weather, on the other hand, the armadillo comes out in the afternoon, or, if it is very cold, not at all.

Upon leaving its burrow, the armadillo immediately begins to forage. A feeding armadillo is a perfect picture of devotion to duty, for when so occupied it is almost oblivious to its surroundings. It leaves a distinctive and easily-recognized trail wherever it goes, since the tail often drags, making an imprint not unlike that of a rope. It is to be feared that the armadillo receives the blame for many misdeeds perpetrated by other animals which precede it to a given spot, as a result of the noticeable track it leaves.

There are many tall tales about the abilities of armadillos but one of the seemingly wildest is the allegation that it can walk under water. What is more amazing than the story itself is the fact that it is true. There are no confirmed reports of anyone observing an armadillo voluntarily using this method to cross a stream, but several workers have put armadillos into ponds and have seen them walk out a few minutes later. Two factors enable the animal to accomplish this distinctly unmammalian feat. First, the armadillo can survive for six or more minutes without being able to breathe. Second, it has a normal specific gravity of 1.06, so that it can maintain itself on the bottom without too much effort. Armadillos *can* swim and they ordinarily do so when placed in water, although their high specific gravity makes swimming something of a problem. This the armadillo has solved in a most interesting manner. When first placed in water, it sinks, struggles to the surface, gasps and sinks again. Just when it appears that all is lost, it rises, dog-paddles to shore and heads for home. An armadillo which has been swimming is particularly rotund. The reason is that instead of gasping its last while struggling in the water, it was ingesting air so as to make itself lighter than the water.

LEFT & RIGHT—Night photographs by flashlight armadillos foraging in a stubble field. In the photograph at the left, the animal is carrying its t well off the ground—a stance it rarely employ

Photographs from the author.

One of the best ways *not* to hunt armadillos is to dig one out of its hole. In the first place, there are a good many more holes than armadillos. In the second place, most burrows have their entrance at the base of a tree or shrub or in the center of a patch of thorny vegetation, such as wild roses or brambles. Wherever possible, armadillos seem to enjoy digging their holes into the side of a bank (at the base of some tree or bush, of course). This means that the depth of the tunnel below the surface is liable to be considerable.

The number of burrows per armadillo varies with the "diggability" of the soil and may range from two or three to as many as fifteen. The

function of the supplementary burrows is not really known. It has been suggested that they may serve as food traps, but armadillos do not seem to make a point of visiting them regularly. They can and do serve as hiding places, but are likely not dug for such a purpose.

The home burrow is usually more elaborate than the supplementary holes and may have more than one entrance. The nest proper is merely a widened chamber which the animal stuffs with leaves. When retiring the armadillo forces its way into this mass and literally packs itself into bed. This practice doubtless provides good insulation and in part performs the same function as does the fur of most mammals.

The armadillo's method of getting leaves into the nest is unique. The animal makes a pile of leaves, squats down over it and then backs toward the burrow, raking any stray leaves back under the shell with its forepaws. The tail seems to be used as a tactile organ during this operation, but this is not certain. The nesting material is changed at intervals when it gets wet or moldy.

Feral armadillos are primarily insectivorous and any region which will not support a suitable insect population will not support armadillos. This is admittedly a generalization and my faith in its invariable truth was considerably shaken recently by the discovery in the colon of an armadillo of two fairly large pieces of material which were definitely of mammalian origin. Captive armadillos are quite omnivorous and in our laboratories they are fed a routine diet of raw horsemeat and canned dog food. Should they acquire the knack of eating small rodents (or something similar), as some South American species are reported to do, they might be able to move into areas from which they are now excluded by reason of diet.

The armadillo has long been accused of being a destroyer of the eggs of quail and other birds. Several years ago, a good deal of experimentation showed that at most armadillos accounted for a very small amount of damage to quail eggs. As

a matter of fact, there is only one instance recorded in which quail eggs were found in the stomach of a wild armadillo.

Watching an armadillo in its native environs makes one wonder how it can possibly survive for more than a few days. It is noisy and unconcerned and in fact performs its daily rounds with the same fearless oblivion as the skunk or porcupine. One wonders if it, too, has some powerful weapon comparable to quill or scent which gives it free passage through the woods. Surprisingly, the only defenses which the armadillo has are passive, and once caught it would make a delicious meal. But catching an armadillo is no mean trick. The animal is deceptively fast and in addition has its shell to rely upon.

There is probably more long-standing misinformation about the armadillo's shell than about any other portion of its anatomy. Early authors (and unfortunately some very recent ones) claimed that the armadillo rolled "into an ironclad ball" when threatened, and some even said it rolled down hill to escape its enemies. In the first place, a Nine-banded Armadillo cannot be rolled into a closed ball. I have tried unsuccessfully to do this with anesthetized animals. Now, the South American Three-banded Armadillo (*Tolypeutes tricinctus*) can and does roll into a ball. In this species the shell is very sturdy and the edges fit together perfectly. C. C. Sanborn reports that the shell is adequate protection from predators and that dogs will not even pursue the Three-banded Armadillo, although they make great sport of chasing and capturing the Six- and Nine-banded Armadillos in the same area. So far as is known, no other armadillo rolls into a ball when attacked. The real function of the Nine-banded Armadillo's shell is similar to that of the cowboy's chaps. An armadillo can plunge full tilt into underbrush so thick and thorny that nothing except another armadillo could hope to follow it. In addition, the shell offers no mouthhold for any would-be predator. The effectiveness of the armadillo's defenses is borne out by the paucity of reports of the finding of armadillo remains in the stomach contents of such predators as wolves, coyotes, cougars, etc.

Although the shell is one of its main lines of defense, it is at the same time perhaps its biggest limitation. The armadillo has poor temperature control and is in fact unable to maintain a constant body temperature in the face of low air

temperatures. This intolerance of cold results in part from the loss of hair in favor of the dermal scutes which comprise the shell. Actually this is not the whole story, for the armadillo has a normal body temperature considerably below that of most mammals. Although the point has not been checked, it seems probable that it has a lower basal metabolic rate than is normal. Perhaps the low metabolic rate represents an adjustment of energy production to that which can be profitably retained by the body. As previously mentioned, the method of nest construction may play a role compensatory for the lack of fur.

The armadillo does not hibernate, but it is able to remain in the nest several days, and in an area where there are no prolonged spells of freezing weather it seems able to forage sufficiently in the warm periods between freezes.

THE SPREAD of the armadillo in the United States is interesting in that it has not been simply the ballooning of the range in an ever increasing arc, but has been quite directional. After crossing the Nueces River around 1880, the armadillo moved north and west and in the early years of this century had reached the central part of the Texas plains region. In addition a finger-like projection of the population went directly up the Pecos Valley in West Texas and entered New Mexico. The armadillo does not presently occur in this area and so far as can be determined, has been absent for more than twenty years. The Pecos region is normally too arid to support the insect life on which armadillos feed and it must have been a series of extremely fortuitous events which allowed it to move into this area even temporarily.

Halted to the west, the armadillo turned eastward and moved quickly up the coastal prairies into the forests of East Texas and Louisiana. It had acquired the unearned reputation of being a denizen of semi-desert country, and it was surprising to many to discover that the armadillo took quite readily to the swamps of Louisiana. In fact this state is the only one which can claim to be completely populated by the Nine-banded Armadillo. In Louisiana the animals again turned north along the Canadian-Arkansas-Red river system and moved by this route into Arkansas and Oklahoma before the vanguard of the main Texas population had reached the Oklahoma-Texas border. The armadillo has been unable to stay in large numbers in upper Oklahoma and Arkansas but is found abundantly in the southern portions of both states.

LEFT—In dry, tangled country like this, the armadillo is thoroughly at home. RIGHT—The author brings a specimen to a field laboratory. This is the "only effective way to hold an armadillo," he says.

The Mississippi river appears to have posed somewhat of a barrier to the eastward movement of the armadillo but it has been crossed in southern Louisiana. Exactly how the crossing was effected is not certain. It is possible the armadillo swam across, but this was most likely accidental. Perhaps animals trapped by flood waters were deposited on the far bank somewhere downstream. Certainly some have been carried across by people.

In two instances man has materially aided the

armadillo in conquering new territory. Colonies are well established in parts of Alabama, obviously having been brought in by human agency. The same thing happened in Florida and this case is interesting in that the entire armadillo population in that state apparently arose from a comparative handful of animals brought in on three separate occasions. A pair was liberated near Miami during World War I and increased for a while but has since died out or moved northward. A few animals escaped from a small zoo near Cocoa in 1924 and several were lost from an overturned circus truck in the same area in 1936. The armadillo presently occupies some 15,000 square miles of the state, being found along the eastern coast from just above Miami northward to Jacksonville and almost spanning the state near Tampa.

As the foregoing paragraphs indicate, we have a fair knowledge of the spread of the armadillo in the last century. Before that time, however, we know little or nothing. It is generally assumed that the Nine-banded Armadillo had a stable range prior to the 1850s but the record is meager on this point.

The only indication that the armadillo had a stable range a hundred years ago is the fact that early journals and accounts of life in Texas refer to it as a Mexican animal which sometimes found its way north of the Rio Grande. Several workers have expressed the belief that the decimation of the larger carnivores, which occurred as the coun try was being settled, allowed the armadillo to move into new territory. Certainly the armadillo *was* moving north at this time, but there is no proof that it had not been moving upward from South America for several centuries and that this movement was noted only when civilization had pushed far enough south to meet it. It has already been mentioned that there is little proof that predation ever was a problem to the armadillo.

A few years ago W. Armstrong Price and Gordon Gunter, the former a geologist, the latter a biologist, combined their talents in an article concerning possible causative factors in the range expansion of the armadillo and several other animals and plants. Prior to the 1870s the so-called chaparral brush of which mesquite is the dominant species was confined to the southern part of Texas, generally south of the Nueces river. In that decade and following, the chaparral began to encroach upon the coastal prairies to the north and east. It is postulated that overgrazing, coupled with several droughts in the 1880s, allowed the chaparral to supplant the grasses. Concomitant with these changes, several animals including the Coati-mundi and the armadillo moved into the same area. The armadillo has long since outstripped the chaparral, which stopped at the edge of the humid zone, but the possibility that this fundamental ecological change triggered the northward push of these animals is most intriguing.

It is my feeling that there is too little evidence to support the contention that the armadillo had a stable range in the past, and I rather tend to the idea that the armadillo has been advancing for some considerable time. If, however, this is not the case, I think that research of the type reported by Price and Gunter approaches most closely the real answer to the problem.

There is little doubt that its limited ability to withstand cold will finally determine the northern limit of the armadillo's range. At least twice in the past the northern limit has been described. The latest was offered in 1913 by H. H. Newman, who suggested that the armadillo would not be able to stay permanently north of the 33rd parallel. Since the 35th parallel cuts across Oklahoma and Arkansas at about the upper limits of the armadillo's present range, and there are already several reports of the animal being found in Kansas and Missouri, it appears as yet unsafe to select still another line beyond which it will not pass.

The armadillo presently occupies a quarter of a million square miles of the United States. It has surely reached its westernmost point and now may be doing the same thing in the north. This is not the situation to the east, however, and unless conditions are drastically altered we can expect in our lifetimes to see the link-up between the populations in Alabama and Florida with the main group which is now beginning to surge into Mississippi. Perhaps in the year 2054 some naturalist, in describing the distribution of the Nine-banded Armadillo in Tennessee and the Carolinas, will preface his report: "In 1854 J. J. Audubon . . ."

The 54th Expedition of Our Department of Tropical Research—

A SUMMER IN ASIA

By WILLIAM BEEBE

USUALLY, after a season at Simla in the northern range of Trinidad, the staff members of the Department of Tropical Research foregather for a summer in the laboratory in the Zoological Park. The field work is correlated with references in the literature; specimens are identified or sent away to specialists, and papers take shape for final publication.

This time, owing to a happy concatenation of events, this sequence will be reversed; half-digested notes laid aside for a time and entirely new activities undertaken.

The itinerary and personnel of the newly-planned expedition are as follows: Beebe, Crane and Kenedy sailed on the *Andrea Doria* from New York on May 19 for Naples. The party is joined by our friends Redfield Vose, Polly Evans and Laura Schlageter, and will sail on June 8 on the *Asia* for Singapore. From then on, the length of stay and possible trips to Darjeeling, Borneo and Colombo will be governed by individual researches, and by travelling conditions.

For Jocelyn Crane the trip will be the vital first phase of a world-wide, five-year study of fiddler crabs and their relations, collectively known as ocypodids. To a comparative behaviorist, this First Family of Crabs is one of the most exciting groups in the animal kingdom. Their accomplishments range from complex color changes to a knack of sifting food from the mud of a tropical swamp. Their courtship displays are so distinctive you can recognize the species by the patterns of their claw-waving, side-stepping dances. Some spend their adult lives in a three-inch circle, and one can keep pace with a cantering horse. Lots of them fight their rivals and a few even make noises.

The entire ocypodid undertaking is being made possible by a grant from the National Science Foundation. The work this summer will be centered around Singapore, where legions of the crabs thrive on the beaches and in the muddy mangrove swamps of Malaya. There Miss Crane expects to observe, photograph and collect some twelve genera and fifty species. En route, too, are made-to-order opportunities for work — stops in Suez, Aden, Karachi, Bombay and Colombo. To others these names hold all the glamor of the East, but to a devotee of ocypodids they are, first-of-all, the homes of unknown fiddlers, beckoning on a far-off muddy shore.

As for myself, I have two main objects in making this trip. Exactly forty-five years ago I travelled through most of the Far East: India, Ceylon, the Malay States, Java, Borneo, the Himalayas, China, Mongolia and Japan, and as a result produced a four-volume Monograph of the Pheasants. Today I will gather whatever information is available as to changes which have taken place in the populations of wild pheasants throughout the intervening almost half-century.

A second concern will be a comparison between the faunas of Singapore Island and Trinidad. The two islands offer several reasonable comparisons, such as their geographical location closely adjoining continental mainlands, as well as being on opposite sides of the earth. Their size is not too dissimilar, both are humid and tropical, and both were colonized by the British, resulting in an unusual amount of wild life studies.

Such phases of life as adaptations to flight in various phyla, correlation of the activities and exact niches occupied by avian families, such as sunbirds and hummingbirds — these and many

other comparisons will give renewed interest to well-known facts.

My share in the expedition is due to the generosity of Redfield Vose. His single stipulation, that he be permitted to join the party, made the friendly action perfect for the Tropical Research participants.

Rosemary Kenedy is accompanying the party as far as Naples, from where she will visit leading museums in Italy, France and England to study and photograph certain types of neotropical moths. These are the day-flying moths which three members of the department at present are studying. Their larvae show most interesting habits[1] and adults exhibit astonishing examples of mimicry.

The word *Type* is the key to Miss Kenedy's study. The *Type* of any species of animal life is the original specimen from which the first description was made. It is like the original of the Declaration of Independence or an Old Master painting compared with any number of copies. It is a precious possession of the museum in which it is deposited and is never allowed to leave the building. Much of the lasting value of scientific names depends on comparison with the original type. These are the specimens which will be studied and photographed.

The major work will be done with the collections at the British Museum (Natural History), the museums at Tring and Oxford, and with Dr. W. J. Kaye's private collection of Trinidad specimens. In Turin Miss Kenedy will complete arrangements for the shipment of a valuable collection of *Uca* crabs which Miss Crane desires for study in New York.

Henry Fleming will keep the laboratory in the Zoological Park open, and carry on his researches into the systematics of the Ctenuchidae or day-flying moths. He will also begin work on the same family taken in Rancho Grande in Venezuela.

[1] Animal Kingdom, February, 1954.

News from the Conservation Foundation

Flood Control Study Is Widely Used

Just a year after publication, our "Flood Control Controversy" has gone into a second printing. Authors Leopold and Maddock, back from a six-weeks' trip to India where they advised on flood control plans and problems, found that the book was actively used in the development of new thinking on flood control problems. They also found it being used in hydraulic laboratories in France and England. Part of the book has been translated into Portuguese for distribution in Brazil.

Arid Lands Conference

Research Director Robert G. Snider attended the Arid Lands Symposium at the University of New Mexico under joint auspices of UNESCO and the American Association for the Advancement of Science and a subsequent conference of experts at the Institute of Mining and Technology at Socorro, N. M.

Water Law in the East

Knotty questions of water allocation are being debated in several State legislatures in the eastern part of the United States — a result of the vastly increased demand for water since the war. This demand is compelling a new look at the way water resources are currently managed and at the present legal basis of water use.

The Conservation Foundation is now analyzing cases and statutes in six representative States in the East. Russell Lord, a writer on agricultural and resource topics, will put the results of the research into popular form for legislators and leaders of industrial, agricultural and urban interests. The project should be largely completed by the end of the year.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM AND THE DEPARTMENT OF TROPICAL RESEARCH

Our Congo Peacock Photographs Now Hang in the Congo

Six years ago this mid-June, Charles Cordier came back from a twenty-months' expedition to the Belgian Congo with a plane-load of animal rarities for us, including the first Congo Peacocks (*Afropavo congensis* Chapin) ever exhibited alive. Although they are not uncommon in certain parts of the Belgian Congo, none have been sent out since that time and our three fine males are still the only ones on exhibition anywhere. Our single female in the original collection was lost as the result of an accident, but while we still had a pair Staff Photographer Dunton made several excellent photographs of them, one of which Dr. James P. Chapin, the discoverer of the bird, reproduced in his "Birds of the Belgian Congo."

Dr. Chapin is now in the Belgian Congo and a few weeks ago he wrote to say that the Institut pour la Recherche Scientifique en Afrique Centrale (IRSAC) would be pleased to have copies of the photograph to hang in the IRSAC library at Leviro, alongside a panel telling the story of the discovery of the Okapi, another great Belgian Congo rarity. Enlargements have been made and mailed and so visitors to IRSAC can at least see a photograph of the Congo's greatest ornithological prize. To see live Congo Peacocks, they would probably save time and money by making a trip to the Bronx Zoo!

How to Tempt the Appetite of a Callimico

Because we are the first zoological park to exhibit the strange little Callimico, or Goeldi's "Marmoset," *Callimico goeldii,* we have had to chart our own course in outlining a diet for it. This did not appear particularly difficult, since small monkeys and marmosets thrive on a diet of various fruits and vegetables.

Our first Callimico came from the upper reaches of the Amazon, near the Peruvian border, in mid-December and died just a month later; a second specimen came in March of this year and lived less than a month. Both fed sporadically and sparsely.

On the theory that perhaps a pair would keep each other company and therefore become more quickly and easily adjusted to life outside their native forests, we obtained a lively pair of the animals. Psychologically they seemed well adjusted, but dietetically they followed the same pattern as the previous specimens – banana they ate fairly well, orange juice with vitamins they drank willingly enough, but other fruits and vegetables they scarcely touched.

It is routine to provide small anolis lizards to supplement the fruit diet of marmosets but in this instance lizards were inadvertently omitted from the feeding instructions drawn up by the Veterinarian. After a few days – not realizing that up to then they had been given no lizards at all – he decided to increase their allotment of meat. He thawed two deep-frozen lizards and casually approached the Callimicos.

Let Us Know Where You're Going This Summer

It's perfectly simple for us to send announcements of special events and your copy of ANIMAL KINGDOM to your summer address –if we know what it is. A postcard to Membership Department, The Zoological Park, New York 60, N. Y., will do the trick. You need to tell us only what your summer address will be – when you're going – when you're coming back to your regular address. Three things only.

"I thought those Callimicos were going to break down the front of their cage and leap on me," he said later.

They were frantic in their efforts to seize the little lizards, which they had seen from ten feet away. They chirped and twittered, reached through the wire screen of their compartment, and the instant Dr. Goss offered the food they grabbed it and began chewing as if they had been starved for a week.

Since that time we have routinely given them two lizards a day and their appetites have improved enormously. Hospital Attendant Waltz reported that in addition to the lizards, they ate more than twice their usual amount of fruits and vegetables every day.

The Callimicos are now being cared for by Mrs. Martini in the Animal Nursery until a place is made ready for exhibition. — W. Br.

We Are Attempting to Hatch a Brood of King Cobras

There are records of several species of cobras mating and nesting in captivity and the eggs subsequently hatching. The mating and nesting of the King Cobra of southeastern Asia has never been observed, however, as far as we can discover, until this spring when a female in our collection was seen to mate with one of two males. Thirty normal eggs and 11 small, unfertilized eggs were found in the female's self-made nest of bamboo leaves on the morning of April 25.

All but a dozen eggs were removed the same day for incubation under controlled conditions of heat and humidity, and a few days later the remaining eggs were taken out of the nest when it was found that some, at least, had begun to decay in the extreme dampness of the pile of vegetation.

The eggs being incubated in leaves, moss and damp paper by Dr. Oliver and Headkeeper of Reptiles Spencook are developing normally. No one knows how long it takes King Cobra eggs to hatch but it is probably in the order of six to eight weeks. In any event, from the middle of June onward, Dr. Oliver will inspect the incubating eggs by means of long forceps to lift the protective covering! — W. Br.

New Englanders in the Zoo — 15,600 of Them

For a good many years the bus companies of nearby New Jersey communities have run summertime bus excursions to the Zoological Park. In mid-April the New Haven Railroad ran what turned out to be the first of six special "Zoo Trains" from Connecticut and Massachusetts. They have been successful beyond the most sanguine expectations of the Zoological Park and the railroad.

Each of the six trains has been filled to its capacity of 2,600 persons, so that a total of 15,600

New England arrives at the Zoo

New Englanders were brought on a one-day excursion to us in the past six weeks. The trains arrived at and departed from the Van Nest yards a mile or two east of the Zoo and the passengers were brought to the Buffalo Parking Field in buses engaged by the railroad.

Herbert Knobloch and Miss Marion McCrane of our Education Department accompanied each train on its journey to New York, carrying pet and baby animals and answering questions about the Zoo.

The venture has been so successful from all points of view — particularly that of our visitors, whose enjoyment of the excursion was obvious— that there is a good chance it will be repeated next spring.

IN BRIEF

Teen-age Problem. Two young Steller's Sea Lions were introduced in the Sea Lion Pool recently after a quarantine period in the Animal Hospital demonstrated that they were healthy

and had a good appetite for fish. No difficulty was expected when they joined the California Sea Lions in the Pool – a large bull, an adult female and their two-years-old offspring, Benny. Trouble did develop, however. Benny has been so aggressive toward the newcomers that they had to be removed. They are again feeding well in the Hospital and will soon be returned to the Pool. If "teen-age" Benny still annoys them, *he* will be removed.

Parking Fee Raised. Parking fees at our four lots have been increased from 35 cents to 50 cents – a rate well below most fees in New York. Members of the Zoological Society get free parking.

New "Little Women." The four young Chimpanzees in the Great Apes House for the past two years finally attained a size that made it advisable to replace them with smaller specimens. Four new "Little Women" – Amy, Jo, Beth and Meg – went on exhibition on April 16 and they are as playful as only young Chimpanzees can be.

How to Handle a Cobra. Periodically this spring our female King Cobra has exhibited a marked swelling in her neck. It finally became so pronounced that close examination was ordered. Dr. Oliver maneuvered the forward part of the snake into a clear plastic, tube three feet long and three inches in diameter, which safely immobilized it for X-ray examination. Close inspection revealed nothing seriously wrong, although the swelling continues to come and go. There were a few critical moments while Dr. Oliver was urging the snake to enter the tube, but fortunately she is a quiet and gentle reptile and she made no "passes" at anyone.

Holothurin. Together with biochemists from Mt. Sinai Hospital, Dr. Nigrelli has completed a preliminary analysis of the chemical composition of Holothurin, an extremely poisonous substance from a species of West Indian sea-cucumber – a substance discovered and named by Dr. Nigrelli in 1952. Dr. Nigrelli and Father T. D. Sullivan, S.S.E., have found that the lives of mice doomed to an early death by a certain type of cancer can be greatly prolonged by Holothurin. It is, of course, an extremely long step from the laboratory mouse to the human patient, especially when a substance as toxic as Holothurin is involved, but the material holds considerable interest for research people.

NEW YORK
MEET PETE AND FRIENDS
PETER II AND PHOEBE ARE 3-YEAR OLD 700 lb BABY HIPPOS, FROM EAST AFRICA.
THESE MASAI GIRAFFES
NEAL AND DOTTY (THE TALL ONE) ARE ALSO JUST KIDS. ALL ARE AT BRONX ZOO.
(10-5 WEEKDAYS, 10-6 SUN. AND HOL.)
NEW YORK
CROCODILE FROM THE NILE
THIS TOUGH CUSTOMER FROM EGYPT'S FABLED RIVER IS ONE OF SCORES OF INMATES
(RATTLESNAKES, COBRAS, PYTHONS, ETC.)
OF THE WORLD'S
FINEST REPTILE HOUSE AT THE BRONX ZOO.
(10-5 WEEKDAYS; SUN. AND HOL. 10-6)

Subways all over the city will carry these advertisements during spring and early summer.

"Mr. Ramshaw." The trained Golden Eagle named "Mr. Ramshaw," which Capt. C. W. R. Knight has used in his lectures here and abroad for several years, has been deposited with us for temporary "boarding." Keeper Joe Bell of the Aquatic Bird House has been working with the bird, to keep him in habits of obedience. Normally, when not in training, he is on exhibition in the Eagle Aviary.

Memorial Tree. A Japanese Pagoda Tree, a flowering variety, has been planted in the lawn southeast of the Elephant House, in memory of Mildred Levine of the Education Department whose death occurred last year. The tree was acquired by her associates in the Education and other departments.

Approaching the Record. Cecil and Penelope, the Duck-billed Platypuses, are now in their ninth year in the Zoological Park, having arrived on April 25, 1947. David Fleay, the Australian zoologist who brought them to us, kept a platypus for more than ten years in Australia. Our specimens appear to be healthy and in good condition, so that they may eventually exceed Fleay's record. They were put on exhibition on May 7 and may be seen each afternoon between 2 o'clock and 4 o'clock.

Spring "Zoo" Parties. An increasing number of clubs and organizations around the city have formed the habit of holding luncheon meetings in the Zoobar Restaurant in spring or fall. Among them this spring are the American-Scandinavian Foundation, the University Club, the Coffee House, Princeton Class of '09, the Century Association, the Society of Women Geographers and the Bronx Women's Club.

U.N. at the Zoo. Members of delegations to the United Nations from about 50 countries visited the Zoological Park on May 20 and were guests of the Zoological Society at lunch. The visit was arranged by Richard C. Patterson, Jr., the New York City Commissioner of Commerce & Public Events, a new member of the Board of Trustees of the Zoological Society.

THE MORNING'S MAIL

In early April we had a telephone call from the Director of the Zoological Gardens in Kansas City. He was trying to raise money to buy baby Elephants for the Gardens: did we have any motion pictures that would aid the campaign? We have "Let's Look at Elephants," the excellent film made from footage shot in Africa by Saul Blickman, a Member of the Society, and it went to Kansas City by return post. It came back with the following comment:

. . . We were able to show it to several interested groups, and we had it shown on the TV program which is collecting to buy the baby elephants. I am sure it helped us a lot in obtaining them. An important factor is showing the difference in the African and the Indian elephant, as many people are inclined to think, "They already have elephants, why do they want more?" unless we are able to clearly define the difference. Your film does that admirably. Thanks very much for helping us out. We really enjoyed the film ourselves.

WILLIAM T. A. CULLY
Director

PUBLICATIONS OF INTEREST

ASPECTS OF DEEP SEA BIOLOGY. By Norman B. Marshall. 380 pp. Illus. in color and in black and white. Philosophical Library, Inc., New York, 1954. $10.00.

Bathyspheres and bathyscapes notwithstanding, practically all our knowledge of what goes on at or near the bottom of the sea must be attained by laboriously lowering for miles the nets and dredges that return with but minuscule samples of what actually exists in the vast depths of the ocean. Putting together the innumerable disjointed facts thus acquired to make a sensible picture of a world we have never seen has many of the attributes of good detective work, as Mr. Marshall shows, both in his review of what other investigators have concluded and in some clever deductions of his own.

The deep-sea investigations of the New York Zoological Society, under the direction of Dr. Beebe, have contributed most importantly to our understanding of deep sea life. More than a tenth of the citations made in this book refer to scientific work done by Dr. Beebe and his collaborators. — J.W.A.

DEVELOPMENT OF COLOR IN BUDGERIGARS. By E. W. Brooks. Pp. 48. All-Pets Books, Inc., Fond du Lac, Wisc., 1955. $2.00.

The genetic relations of the now numerous color varieties of Budgerigars, or Shell Parrakeets, are extremely complicated and cannot be fully grasped unless it is understood that the only pigments involved are brownish black melanin and yellow lipochrome, the various blues and greens being caused by light reflections from these basic materials. Presence, absence, or degree of intensity of one or both of these pigments and the resulting visual colors are fully and carefully explained by the author in this useful and instructive little book. — L.S.C.

PREHISTORIC ANIMALS. By William E. Scheele. Illustrated by the author. Pp. 128, numerous black and white illustrations. The World Publishing Company, Cleveland and New York, 1954. $4.95.

This outline of the major animal milestones along the evolutionary road of past ages has many attractive features to recommend it. It is copiously illustrated, but a number of the drawings are so vague as to detract from their value as scientific illustrations. — J.A.O.

ATTRACTING BIRDS TO YOUR BACKYARD. By W. J. Beecher. Pp. 63. Illus. black and white drawings by the author. All-Pets Books, Inc., Fond du Lac, Wisconsin, 1955. $1.00.

Neatly bound in an attractive hard-paper cover, this little book conveys, at a very small price, more sound and sensible information on attracting birds than is found in many larger and more expensive volumes. In addition to detailed suggestions for planting food-bearing shrubs, erecting bird baths, food platforms and nesting boxes, Dr. Beecher has added descriptions of the common birds of various areas. — L.S.C.

DINOSAURS. By Herbert S. Zim. Illustrated by James Gordon Irving. Pp. 64, numerous black and white figures. Morrow Junior Books, William Morrow and Company, Inc., New York, 1954. $2.00.

This recent addition to the Morrow Junior Book series is another happy result of the collaboration of Herbert S. Zim and James Gordon Irving — a well-written and well-illustrated elementary account of the dinosaurs and their relatives. — J.A.O.

WILD ANIMALS WE WILL NEVER KNOW

The YALE as represented in "The Book of Beasts," a Latin Bestiary translated and annotated by T. H. White.

We haven't any Yale in the New York Zoological Park, and there is no likelihood that we will ever have one. But then there are many other fancied creatures in T. H. White's "The Book of Beasts" which we do not expect to welcome in the Bronx. There are the Phoenix, the Draco and the two-headed Amphivena, to name a few.

In case you don't know about the Yale, it is as big as a horse, black in color, with the tail of an elephant and the jowls of a boar. Its outlandishly long horns may be moved "as the needs of battle dictate." In combat the Yale points one horn forward and holds the other in reserve. Pliny is said to be the first to have described the Yale, but no one is entirely sure what beast he may have had in mind. However, the Yale or Eale became a popular heraldic figure and furnished the supporters for the arms of Christ's College, Cambridge, among other distinctions.

In any perusal of "The Book of Beasts," it is important to realize that every creature included in this translation is there in all seriousness. Ludicrous as some of the descriptions may seem, they represent the honest beliefs of the chroniclers. As White says, when one first meets up with a Bestiary he is irresistibly reminded of Hilaire Belloc's "A Bad Child's Book of Beasts." However, a Bestiary is a sincere scientific work. These primitive natural histories had no particular authors, but were merely compilations or "a kind of naturalist's scrapbook." Their sources go back to the most ancient of civilizations, to mythology and "ultimately to oral tradition which must have been contemporary with the caves of Cromagnon."

Mr. White, who wrote that charming book, "The Sword in the Stone," claims the Physiologus as the immediate ancestor of his "Book of Beasts." The Physiologus was an anonymous scribe who is thought to have appeared between the Second and Fifth Centuries A.D., probably in Egypt. He compiled this account, possibly in Greek, from which language it was translated into many, many tongues, and was so popular that some authorities believe it to have been next to the Bible in what we now call reader interest.

With its copious footnotes and appendix, "The Book of Beasts" is of concern to us today for it represents what people knew or thought they knew of the Animal Kingdom as late as the 12th Century when the Latin version of Physiologus was compiled, from which Mr. White has translated the work in question.

As members of the New York Zoological Society, perhaps our main point of interest in this book lies in the fact that it has been actually only within the last couple of centuries or so that any substantial body of biological lore has been developed, and prior thereto man was content to pass along old wives' tales about his animal friends. Our Society has, even in its short lifetime, made substantial contributions to our knowledge and will continue so to do.

For instance, this is what "The Book of Beasts" has to tell about Cancer the Crab, and this is all: "Cancer the Crab goes in for a cunning stratagem, due to his greed. He is very fond of oysters and likes to get himself a banquet of their flesh. But, although eager for dinner, he understands the danger, since the pursuit is as difficult as it is hazardous. It is difficult because the inner flesh of the oyster is contained within very strong shells, as if Nature its maker had by her imperial command fortified the soft part of the body with walls. She feeds and cherishes this flesh in a kind of arched dome in the middle of the shell: disposes it, as it were, in a sort of hollow. For this reason, the handling of oysters has to be done carefully, because nothing can open the closed oyster by force, and thus it is dangerous for the crab to insert his claw. Betaking himself to artfulness, therefore, the crab lays an ambush with a new plot of his own. Because all species delight in relaxing themselves, the crab investigates to find out whether at any time the oyster opens that double shell of his in places remote from all wind and safe from the rays of the sun, or whether it unlocks the fastenings of its gates, so that it may pleasure its internal organs in the free air. Then the crab, secretly casting in a pebble, prevents the closing of the oyster, and thus, finding the lock forced, inserts his claws safely and feeds on the internal flesh."

Shortly a staff member of our Department of Tropical Research will fare forth on a three-year, 'round-the-world pilgrimage in search of further truth about only *one* species of Cancer the Crab!

No, we haven't any Yale and don't know where to find one, and there are many other legendary animals we shall never have in the Zoo. On the other hand there are many more that we shall learn about, either through study here at the Park and the Aquarium or in such research outposts as our Simla in Trinidad or at Jackson Hole.

Over the years the scientific work of the New York Zoological Society has been sponsored by the Society's friends — our members. Below are listed the names of those who have joined or changed in membership status since the last issue of this magazine.

New Members of the New York Zoological Society

Life

B. W. Haxall
George W. Merck, Jr.
Hon. Richard C. Patterson, Jr.

Contributing

Ethan Allen
Mrs. Ethan Allen
William D. Barry
Mrs. Robert E. Burns
Kenneth Caron
Mrs. William Andrews Clark
Mrs. Henry B. Coakley
C. N. Wentworth Cumming
Dr. Douglas S. Damrosch
Dr. William E. Davis
Wilbur Downs
Mrs. Wilbur Downs
John E. Dumaresq
Mrs. Francis P. Garvan
Mrs. Arthur Gengler
Jerrold Greenberg
Dr. Portia Hamilton
John E. Heintz
Edward K. Hessberg
Isaac Lapidos
Miss Janet S. Lippencott
William A. Lockwood
Mrs. John Mayer
Mrs. Charles J. Nourse
Samuel Revits
Mrs. June Havoc Spier
Harry Staub
Harold Steiger
Mrs. Huntington M. Turner
Mrs. Taggart Whipple

Annual

Mrs. L. R. Breslin, Jr.
Gerald J. Creighton
Miss H. S. Curtis
Mrs. Jane Quinn Davis
Miss Else S. deBrun
John V. N. Dorr
Mrs. Jules Ehrich
Miss F. Belle Figger
John Ripley Forbes
Kelly Fox
Robert G. Fredericks
Mrs. Rodman Gilder, Jr.
Harold W. Gillen
Miss E. L. Godwin
Miss Elizabeth Hirt
Al Katz
Joseph N. Kessler
Mrs. Yale Kneeland, Jr.
Herbert Wilson Leff
Mrs. Robert J. Lewis
William H. Meeder, Jr.
Thonglaw Punyanitya
Gary Lawrence Sherman
Max Siegel
Miss Myrtle A. Sperber
John J. Teal, Jr.
William W. Vandivert
Mrs. Eliot B. Weathers
Charles L. Weinberg